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ABSTRACT

After a brief discussion of when a school board should consider modernizing mechanical and electrical equipment the speaker explored the specifics of lighting, heating, and ventilation. Technical data on foot candles, types of light fixtures, and the importance of air conditioning in modern school buildings are presented. The presentation concludes with the recognition of the need for research on air conditioning in existing buildings. (GM)

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When and What to Modernize

by D. Dana Price*

MODERNIZATION SHOULD BE UNDERTAKEN ONLY AFTER THE FEASIBILITY OF THE PROJECT HAS BEEN STUDIED BY A COMPETENT ARCHITECT AND ENGINEER

Modernization of the mechanical and electrical equipment of a school plant is usually considered when:

1. Money is not available for a new building and it is thought that for a small amount of money the old building can be made like new.
2. Some part of the system breaks down completely.
3. New buildings are being planned on the same site.

In the case where money is not available for a new building and an attempt is being made to modernize a building over twenty five years old, a competent architect and engineer should be commissioned to study what can be done, what the cost will be, and to advise whether or not it is feasible. Sometimes it is better to pay a competent professional to make a feasibility study and to be advised if you would be wasting your money rather than blindly start issuing contracts to several independent contractors. In most cases large expenditures on very old buildings cannot be justified. It would be better to organize a Citizens' Committee and plan a modern school which would show less owning and operating cost over a twenty year period.

Now consider the time when some part of the system has broken down completely. This certainly is not the ideal time to make a decision on a major modernization of the mechanical and electrical system in a building.

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If possible it is far better to get the system operating again even though it should cost several hundred dollars to patch it up. Major decisions should not be made without competent professional help and certainly not under the pressure of getting the heating on again or a similar urgency. When tempted to make a decision under these conditions, call your architect and engineer and request that a study be made of an over-all modernization plan. Money spent this way does two things. It takes the problem out of the hands of little pressure groups who are usually very prejudiced and it eliminates the possibility of the superintendent being criticized for making a decision on something that he does not have adequate knowledge.

When the decision to modernize the mechanical and electrical equipment is considered in conjunction with a new building being planned on the same site, the same architect and engineer should be commissioned to study both problems.

When this is done and if the existing building is not too old, usually an attempt is made to reduce the noticeable difference between the old and the new buildings. This is not an easy problem because there has been such a tremendous change in thinking in the last few years about what a school building should be. Regardless of this, planning for the new building should include the best thinking available at the time the building is being designed. There are many cases when buildings are antiquated even before construction is started. Money should never be spent this way. Allow your architect and engineer to plan a modern building embodying the best technical thinking and then if you have the money, see what you can do to upgrade other buildings on the same site. (Buildings on other sites should not be affected or considered as part of this problem.)

Now, what are some of the things that we have to do to modernize the mechanical and electrical plants in the old building?

First, the records of the business manager should be consulted to determine if some parts of the system are requiring unusual expenditures for service and how frequently these expenses occur. This is the easiest way to find trouble and it disturbs the least number of employees. Obviously these things when found should be fixed properly or replaced. Sometime good equipment is being serviced by incompetent service personnel. When this is found, replacement should be in personnel and not in equipment.

The two items which require the most in modernization in a building are lighting and heating and ventilation or air conditioning. Most lighting systems over five years old are completely inadequate in terms of today's standards, both from a quantity and quality aspect. Classrooms with windows require from 60 to 100 foot candles to enable students to comfortably read pencil writing on paper; yet very few rooms in this category that are more than five years old will have over thirty foot candles on an overcast day. Most of the rooms will have much less and the quality will be very poor, that is, glare will be prevalent and contrasts much too high for comfort.

Where the existing lighting is incandescent the lighting level can be doubled by replacing the 500 watt fixtures with two four-lamp fluorescent fixtures and the distribution immediately becomes better. This can be done without rewiring because the 500 watts are being replaced with 400 watts. The fixture used should have a diffusing lense and adequate size to prevent hot spots and short lamp life due to overheating. This change can be made very inexpensively since no increase in the number of circuits or the size of the feeders is required. Most classrooms will end up with about 40 foot candles initially in this type of change and the quality should be fair. The value of the lighting can be enhanced considerably if air conditioning is to be added by closing the windows and providing some permanent type of shade to prevent large inside--outside contrasts.

This brings us to air conditioning. Since a modern, compact, air conditioned school costs less to build and less to operate than a non air conditioned building, the chances are good that the new building on the site will be air conditioned. This will usually call for at least a study of what air conditioning will entail if it were to be installed in the old building.

The problem can be reduced considerably if the new building is placed in close proximity of the old building. Most additions will fall into this category so let us look at the problem this way.

Under these conditions the same chilled water or hot water system could be used for both buildings. If a medium or high pressure double duct air distribution system is used, the same hot and cold duct fans could be used for both buildings and the central equipment room will simplify maintenance.

If a gas turbine, high frequency generator, waste heat boiler, absorption chiller combination is used for the new school, the engineer could work out his heat balance to air condition the older school by using auxillary firing in the waste heat boiler to provide the additional steam for the added absorption capacity. This will add to the over-all efficiency of the system because the excess amount of oxygen available in the waste heat boiler will allow the gas to be burned at a much higher efficiency than an ordinary boiler.

This increase in thermal efficiency will offset the excessive thermal losses in the old building and make air conditioning feasible and possible in these buildings.

Air conditioning an existing school where no new building is being considered on the site is a more difficult problem. It will cost more first cost and operating cost.

Since schools will require cooling even in fairly cool weather due to the heat generated by the lights and the human load, it would be advisable that a chilled water system be considered during the cooling cycle to reduce equipment failure.

The type of system that would require the least amount of maintenance would be an all air high velocity double duct system with a central hot and cold deck system. This system also readily adjusts to varying loads and has the advantage of requiring the least amount of space within the building. The alterations within the building would be furring the hall ceiling down, cutting holes for grilles and running control tubing to thermostats. Outside of the building it would be required that a room be provided to house the air conditioning equipment.

This type of installation would cost about \$1,000 per ton to purchase and each thirty-pupil classroom would require about three tons of air conditioning.

I am certain that some research will be done in the near future which will study air conditioning existing school buildings. This research should result in considerable savings in the first cost and operating cost of air conditioning existing buildings. This is information that everyone today is seeking and it deserves considerable serious thought. Conventional methods will not bring about considerable air conditioning in existing school buildings where there is no new construction on the same site.

I sincerely hope that by next years' "School Facilities Planning Conference" I will be able to give you the answer to this problem.

Thank you.